

# (19) United States

## (12) Patent Application Publication (10) Pub. No.: US 2021/0133428 A1 Gernoth et al.

### May 6, 2021 (43) **Pub. Date:**

### (54) OCCLUSION DETECTION FOR FACIAL RECOGNITION PROCESSES

(71) Applicant: Apple Inc., Cupertino, CA (US)

(72) Inventors: Thorsten Gernoth, San Francisco, CA (US); Ian R. Fasel, San Francisco, CA (US); Touraj Tajbakhsh, San Jose, CA (US); Jia-Chi Wu, Santa Clara, CA

(US)

(21) Appl. No.: 17/150,270

(22) Filed: Jan. 15, 2021

### Related U.S. Application Data

- (63) Continuation of application No. 15/934,559, filed on Mar. 23, 2018, now Pat. No. 10,896,318.
- (60) Provisional application No. 62/556,407, filed on Sep. 9, 2017, provisional application No. 62/556,795, filed on Sep. 11, 2017.

#### **Publication Classification**

(51) Int. Cl. G06K 9/00 (2006.01)G06F 21/32 (2006.01) G06K 9/03 (2006.01)G06K 9/80 (2006.01)

(52) U.S. Cl.

CPC ..... G06K 9/00255 (2013.01); G06K 9/00281 (2013.01); G06F 21/32 (2013.01); G06K 9/00926 (2013.01); G06K 9/00248 (2013.01); G06K 9/036 (2013.01); G06K 9/80 (2013.01); G06K 9/00221 (2013.01); G06K 9/00288 (2013.01)

ABSTRACT (57)

Occlusion of facial features may be detected and assessed in an image captured by a camera on a device. Landmark heat maps may be used to estimate the location of landmarks such as the eyes, mouth, and nose of a user's face in the captured image. An occlusion heat map may also be generated for the captured image. The occlusion heat map may include values representing the amount of occlusion in regions of the face. The estimated locations of the eyes, mouth, and nose may be used in combination with the occlusion heat map to assess occlusion scores for the landmarks. The occlusion scores for the landmarks may be used control one or more operations of the device.



